

Toxicological Assessment of ISS Air Quality: Contingency Sampling – February 2013



Two grab sample containers (GSCs) were collected by crew members onboard ISS in response to a vinegar-like odor in the US Lab. On February 5, the first sample was collected approximately 1 hour after the odor was noted by the crew in the forward portion of the Lab. The second sample was collected on February 22 when a similar odor was noted and localized to the end ports of the microgravity science glovebox (MSG). The crewmember removed a glove from the MSG and collected the GSC inside the glovebox volume. Both samples were returned on SpaceX-2 for ground analysis.

Complete data tables of all measured concentrations and corresponding T-values based on 7-day and 180-day SMACs are enclosed. A summary of those results is shown in Table 1. Shaded rows indicate data that are limited due to low sample pressures. Recoveries of the 3 surrogate standards from the GSCs were as follows:

Lab sample (Feb 5) – ^{13}C -acetone, 101%; fluorobenzene, 98%; and chlorobenzene, 78%

MSG sample (Feb 22) – ^{13}C -acetone, 125%; fluorobenzene, 110%; and chlorobenzene, 97%

The sample pressure of the GSC collected in the Lab was low (4.9 psia) relative to the typical pressure range of 13-14 psia, indicating a problem with sample acquisition. Due to the low pressure, the detection limit was 0.083 mg/m^3 (compared to the normal detection limit of 0.05 mg/m^3). Despite the low sample pressure, the sample was deemed valid due to the presence of alcohols, Freon 218 (octafluoropropane), and carbon dioxide at levels that were typical of historic samples and due to adequate surrogate recoveries.

Table 1. Analytical Summary of ISS results

Sample Location	Sample Date	NMVOCs ^a (mg/m^3)	Freon 218 (mg/m^3)	CO_2 (mg/m^3)	Alcohols (mg/m^3)	T-Value ^b (units)
Lab	2/5/2013	6.8	26	5266	4.6	0.23
MSG	2/22/2013	6.9	15	7518	4.9	0.22
Guideline		<25	---	<9300	<5	<1

^a Non-methane volatile organic hydrocarbons, excluding Freon 218

^b Based on 180-d SMACs and calculated excluding CO_2

Toxicological Evaluation of ISS Air Quality: No compounds of concern for crew health were detected in these contingency samples. Concentrations of target compounds and the corresponding combined T-value were low compared to typical routine monthly samples collected on ISS. The vinegar-like smell noted by the crew is likely to be acetic acid. Acetic acid was not detected in these samples; however, the reported odor threshold range for this compound (0.2 – 1 ppm) is well below the detection limit for standard GC/MS analysis of GSCs. In addition, whole air sample collection in evacuated canisters is not the ideal sampling method for acetic acid. A different sampling/analysis method would be required to evaluate on-orbit acetic acid concentrations.

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Date

Enclosures Table 1: Analytical concentrations of compounds found in the contingency GSCs
Table 2: T-values corresponding to analytical concentrations in Table 1.